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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/991,166	11/16/2001	Chentsau Ying	05630 USA P 01/ETCH/METAL	3830

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APPLIED MATERIALS, INC.
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EXAMINER	
VINH, LAN	

ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 11/05/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/991,166	YING ET AL.	
	Examiner	Art Unit	
	Lan Vinh	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 November 2001* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-60* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-60* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☒ Certified copies of the priority documents have been received in Application No. *09991166* .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Objections

1. Claims 2, 12 are objected to because of the following informalities: in line 3 of claims 2, 12, the term "prior to" is repeated twice, the examiner suggests deleting one term "prior to" to clarify the claim language. Appropriate correction is required.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1-4, 6, 27-29 are rejected under 35 U.S.C. 102(e) as being anticipated by Athavale et al (US 6,559,001)

Athavale discloses a process for etching noble metal electrode (Pt, Ir) in a plasma chamber comprising exposing the chamber to a plasma mixture comprises of BCl3 and CF4 (col 3, lines 30-60), which reads on exposing interior surfaces of the plasma etch chamber to seasoning plasma generated from a gas mixture comprises of BCl3 and CF4

Regarding claim 2, Athavale discloses placing a wafer 10/dummy wafer having one Ir layer in a plasma chamber before exposing the wafer to a reactive plasma (col 5, lines 13-54)

Regarding claim 3, Athavale discloses using DPS chamber (col 4, lines 33-34)

Regarding claim 4, Athavale discloses using a plasma power source of 1200 W (overlaps the claimed range of 100-1400 W) and a substrate bias power of 200-450 W (col 4, lines 32-35)

Regarding claims 6, 29, Athavale discloses using Ar in the gas mixture (col 8, lines 56-57)

Regarding claim 28, Athavale discloses etching a Pt electrode (col 6, lines 3-4)

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 5, 7-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Athavale et al (US 6,559,001) in view of Guinn et al (US 5,877,032)

Athavale's method has been described above. Unlike the claimed inventions as per claims 5, 7, Athavale does not disclose the claimed specific time period for applying power and the specific flow rates of the gases although Athavale discloses the flow rate of the gases is less than 50 sccm (table. I)

Guinn, in a method for monitoring plasma etching, discloses that the plasma processing parameters such as: flow rate, time are varied to change the etch rate of the material (col 4, lines 1-5)

Hence, one skilled in the art would have found it obvious to modify Athavale by discovering the optimum values for flow rate, time period for applying power because Guinn discloses that these are result effective parameter/variable in the same field of endeavor.

Regarding claim 8, Athavale discloses the pressure in the chamber is 5-40 mTorr (col 4, lines 35-37)

6. Claims 9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Athavale et al (US 6,559,001) in view of Soga et al (US 6,090,718)

Athavale's method has been described above. Unlike the claimed inventions as per claims 9-10, Athavale fails to disclose the steps of cleaning the plasma etch chamber with a purge gas prior to/after exposing the chamber to the seasoning plasma

However, Soga discloses a dry etching method comprises the step of cleaning the plasma etch chamber with a purge gas prior to/after exposing the chamber to the seasoning plasma/etching plasma (col 10, lines 63-65, fig. 14)

Hence, one skilled in the art would have found it obvious to modify Athavale's method by adding the step of cleaning the plasma etch chamber with a purge gas prior to/after exposing the chamber to the seasoning plasma/etching plasma as per Soga because Soga teaches that a purge process perform between the etching process without

generating plasma within the chamber for removing the reaction product from the etching chamber, so that specific shape, such as a trench, can be formed in the substrate with high accuracy and without generating any black silicon (col 3, lines 39-50)

7. Claims 11-14, 16,19-22, 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Athavale et al (US 6,559,001) in view of Soga et al (US 6,090,718)

Athavale discloses a process for etching noble metal electrode (Pt, Ir) in a plasma chamber comprising exposing the chamber to a plasma mixture comprises of BCl3 and CF4 (col 3, lines 30-60), which reads on exposing interior surfaces of the plasma etch chamber to seasoning plasma generated from a gas mixture comprises of BCl3 and CF4

placing a wafer 10/substrate having one Ir layer in a plasma chamber (col 5, lines 13-54)

etching the IrO2/iridium film using a plasma mixture (col 6, lines 10-15)

removing the substrate from the chamber (col 7, lines 16-17)

Unlike the claimed inventions as per claims 11, 19, Athavale fails to disclose the steps of cleaning the plasma etch chamber with a purge gas/purging the plasma etch chamber of remaining seasoning mixture

However, Soga discloses a dry etching method comprises the step of cleaning the plasma etch chamber with a purge gas after exposing the chamber to the seasoning plasma/etching plasma (col 10, lines 63-65, fig. 14)

Hence, one skilled in the art would have found it obvious to modify Athavale's method by adding the step of cleaning the plasma etch chamber with a purge gas prior to/after exposing the chamber to the seasoning plasma/etching plasma as per Soga because Soga teaches that a purge process perform between the etching process without generating plasma within the chamber for removing the reaction product from the etching chamber, so that specific shape, such as a trench, can be formed in the substrate with high accuracy and without generating any black silicon (col 3, lines 39-50)

The limitations of claims 12, 20 have been discussed above.

Regarding claims 13, 21, Athavale discloses using DPS chamber (col 4, lines 33-34)

Regarding claim 14, 22, Athavale discloses using a plasma power source of 1200 W (overlaps the claimed range of 100-1400 W) and a substrate bias power of 200-450 W (col 4, lines 32-35)

Regarding claims 16, 24, Athavale discloses using Ar in the gas mixture (col 8, lines 56-57)

8. Claims 15, 17-18, 23, 25, 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Athavale et al (US 6,559,001) in view of Soga et al (US 6,090,718) and further in view of Guinn et al (US 5,877,032)

Athavale as modified by Songa has been described above. Unlike the claimed inventions as per claims 15, 17, 23, 25, Athavale and Soga do not disclose the claimed

specific time period for applying power and the specific flow rates of the gases although Athavale discloses the flow rate of the gases is less than 50 sccm (table. I)

Guinn, in a method for monitoring plasma etching, discloses that the plasma processing parameters such as: flow rate, time are varied to change the etch rate of the material (col 4, lines 1-5)

Hence, one skilled in the art would have found it obvious to modify Athavale and Soga by discovering the optimum values for flow rate, time period for applying power because Guinn discloses that these are result effective parameter/variable in the same field of endeavor.

Regarding claims 18, 26, Athavale discloses the pressure in the chamber is 5-40 mTorr (col 4, lines 35-37)

9. Claims 30-37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Athavale et al (US 6,559,001) in view of Richardson et al (US 6,350,697)

Athavale discloses a process for etching noble metal electrode (Pt, Ir) in a plasma chamber comprising : placing a wafer 10/substrate having one Ir layer in a plasma chamber (col 5, lines 13-54)

exposing the chamber to a plasma mixture comprises of CF4 at a substrate temperature of 300 ^{0} C to produce byproduct (col 3, lines 30-60; col 4. lines 37-45) , which reads on exposing interior surfaces of the plasma etch chamber to seasoning plasma generated from a gas that includes at least one principal etchant gas used during an etch process which produced the non-volatile etch byproducts at a substrate

temperature that is equal to or greater than a substrate temperature at which said nonvolatile etch byproduct were produced.

Unlike the instant claimed invention as per claim 30, Athavale does not disclose that exposure of the substrate to the plasma mixture generate entrapment and adhering material which adhere the nonvolatile byproducts to the chamber wall.

However, Richardson discloses a method of conditioning plasma reaction chamber comprises the step of generate polymeric/adhering material adhering to adhere the nonvolatile byproducts to the interior of the plasma chamber (col 2, lines 19-22)

Since Athavale discloses exposing the chamber to a plasma mixture comprises of CF4, it is obvious that Athavale's CF4 gas would have generated entrapment and adhering material which adhere the nonvolatile byproducts to the chamber wall in view of Richardson's teaching because according to Richardson, introducing a fluorine-containing gas into the chamber deposit a polymer coating on interior surface of the chamber (col 2, lines 15-19)

Regarding claims 31-32, Athavale discloses that the wafer includes dielectric layer 40 of BST/inorganic material (col 6, lines 26-33), which reads on a source for entrapment and adhering material

Regarding claims 33, 34, 35, Athavale discloses heating the wafer/substrate to 300^0 C (col 4, lines 39-40). Athavale also discloses heating the wafer/substrate to 200^0 C < 250^0 C

Regarding claims 36-37, Athavale discloses that the gas mixture includes CF4, C2F6 (col 3, lines 59-60)

10. Claims 38-51, 56, 57, 59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hori et al (US 5,411,631) in view of Athavale et al (US 6,559,001)

Hori discloses a dry etching method of metal film. This method comprises the steps of:

placing a substrate/wafer having a silicon oxide layer (col 6, lines 32-50)

supplying Cl2 and BCl3 gases into the etching chamber at a substrate temperature of 50^0 C (col 6, lines 62-64; col 8, lines 43-45), which reads on exposing the substrate, chamber wall and internal surfaces of the plasma etch chamber to a seasoning plasma generated from Cl2 and BCl3 at a temperature

generating etching residue upon the completion of the etching process in the etch chamber (col 5, lines 58-60, col 6, lines 50-51), which reads on the exposure of the substrate to the seasoning plasma generates entrapment and adhering material which adhere etch byproduct to the chamber walls

Unlike the instant claimed inventions as per claims 38, 48, Hori does not disclose exposing the substrate to a plasma at a substrate temperature that is equal to or greater than a substrate temperature at which the nonvolatile etch byproduct were product /250^0 C or greater

However, Athavale discloses a process for etching noble metal comprises the step of exposing the chamber to a plasma mixture at a substrate temperature of 300 ^{0} C to produce byproduct (col 3, lines 30-60; col 4. lines 37-45)

Hence, one skilled in the art would have found it obvious to modify Hori by exposing the substrate to a plasma at a substrate temperature at 300^0 C as per Athavale because

Athavale teaches that employing high temperature during etching facilitates volatilization of the etching byproducts and reduces the sticking coefficient for redepositing species (col 4, lines 41-45)

Regarding claims 39, 40, 50, Hori discloses that the substrate having silicon dioxide /inorganic material (col 6, lines 33-34)

The limitation of claims 41, 56, 57, 59 have been discussed above

Regarding claims 42, 44-45, Hori discloses etching a film having a thickness of 1000 nm at etching rate of 500nm/min (col 5, lines 24-25, col 10, lines 43-45), which reads on etching for a period of 2 minutes

Regarding claims 43, 46, Hori discloses supplying Cl2 and BCl3 gases into the etching chamber at a substrate temperature of 50^0 C<250^0 C

Regarding claim 47, Hori discloses forming photoresist layer 4 over the substrate (col 8, lines 64-65)

Regarding claim 49, Hori discloses that the metal includes copper (col 5, lines 13-14)

Regarding claim 51, Hori discloses adding argon to the plasma mixture (col 5, lines 49-50)

11. Claims 52-53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hori et al (US 5,411,631) in view of Athavale et al (US 6,559,001) and further in view of Guinn et al (US 5,877,032)

Hori as modified by Athavale has been described above. Unlike the claimed inventions as per claims 52, 53, Hori and Athavale do not disclose the claimed specific concentration of gases

Guinn, in a method for monitoring plasma etching, discloses that a plasma processing parameter such as: flow rate/concentration is varied to change the etch rate of the material (col 4, lines 1-5)

Hence, one skilled in the art would have found it obvious to modify Hori and Athavale by discovering the optimum values for flow rate, time period for applying power because Guinn discloses that these are result effective parameter/variable in the same field of endeavor.

12. Claims 54-55, 58, 60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hori et al (US 5,411,631) in view of Athavale et al (US 6,559,001) and further in view of Westendorp et al (US 5,789,867)

Hori as modified by Athavale has been described above. Unlike the claimed inventions as per claims 54-55, 58-60, Hori and Athavale do not disclose that the plasma mixture includes Cl2, N2 and Argon

However, Westendorp discloses a method for igniting plasma comprises the step of generating a plasma mixture includes Cl2, N2 and Argon (col 2, lines 50-61)

Hence, one skilled in the art would have found it obvious to modify Hori and Athavale by generating a plasma mixture includes Cl2, N2 and Argon as per Westendorp because according to Westendorp Cl2, N2 and Argon are gases of the type that operate

in combination with one the other as the ionization element for transformation into a plasma (col 2, lines 47-62, col 4, lines 21-24)

Conclusion

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lan Vinh whose telephone number is 703 305-6302. The examiner can normally be reached on M-F 8:30-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 703 305-2667. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308-0661.

LV
October 30, 2003